

PLATO'S DOCTRINE

RESPECTING THE

ROTATION OF THE EARTH,

AND

ARISTOTLE'S COMMENT UPON THAT DOCTRINE.

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EXAMINATION OF THE THREE FOLLOWING QUESTIONS:—

1. WHETHER THE DOCTRINE OF THE EARTH'S ROTATION IS AFFIRMED OR IMPLIED IN THE PLATONIC TIMÆUS?

2. IF AFFIRMED OR IMPLIED, IN WHAT SENSE?

3. WHAT IS THE COSMICAL FUNCTION WHICH PLATO ASSIGNS TO THE EARTH IN THE TIMÆUS?

PREFACE.

The following paper was originally intended as an explanatory note on the Platonic *Timæus*, in the work which I am now preparing on Plato and Aristotle. Interpreting, differently from others, the much debated passage in which Plato describes the cosmical function of the Earth, I found it indispensable to give my reasons for this new view. But I soon discovered that those reasons could not be comprised within the limits of a note. Accordingly I here publish them in a separate Dissertation. The manner in which the Earth's rotation was conceived, illustrates the scientific character of the Platonic and Aristotelian age, as contrasted with the subsequent development and improvement of astronomy.

PLATO — ON THE EARTH’S ROTATION.

In Plato, *Timæus*, p. 40 B, we read the following words — Γῆν δὲ τροφὸν μὲν ἡμετέραν, εἰλλομένην δὲ περὶ τὸν διὰ παντὸς πόλον τεταμένον φύλακα καὶ δημιουργὸν νυκτός τε καὶ ἡμέρας ἐμηχανήσατο, πρώτην καὶ πρεσβυτάτην θεῶν, ὅσοι ἐντὸς οὐράνου γεγόνασι. I give the text as it stands in Stallbaum’s edition.

The obscurity of this passage is amply attested by the numerous differences of opinion to which it has given rise, both in ancient and in modern times. Various contemporaries of Plato (ἐνιοὶ — Aristot. *De Coelo*, II. 13, p. 293 b. 30) understood it as asserting or implying the rotatory movement of the earth in the centre of the Kosmos, and adhered to this doctrine as their own. Aristotle himself alludes to these contemporaries without naming them, and adopts their interpretation of the passage; but dissents from the doctrine, and proceeds to impugn it by arguments. Cicero mentions (*Academic* II. 39) that there were persons who believed Plato to have indicated the same doctrine obscurely, in his *Timæus*: this passage must undoubtedly be meant. Plutarch devotes a critical chapter to the enquiry, what was Plato’s real doctrine as to the cosmical function of the earth — its movement or rest (*Quaestion. Platonic.* VII. 3, p. 1006.)

There exists a treatise, in Doric dialect, entitled Τίμαίω τῷ Λόκρῳ Περὶ Ψυχᾶς Κόσμῳ καὶ Φύσιος, which is usually published along with the works of Plato. This treatise was supposed in ancient times to be a genuine production of the Lokrian Timæus, whom Plato introduces as his spokesman in the dialogue so called. As such, it was considered to be of much authority in settling questions of interpretation as to the Platonic Timæus. But modern critics hold, I believe unanimously, that it is the work of some later Pythagorean or Platonist, excerpted or copied from the Platonic Timæus. This treatise represents the earth as being in the centre and at rest. But its language, besides being dark and metaphorical, departs widely from the phraseology of the Platonic Timæus: especially in this — that it makes no mention of the cosmical axis, nor of the word εἰλλομένην or εἰλουμένην.

Alexander of Aphrodisias (as we learn from Simplicius ad Aristot. *De Coelo*, fol. 126) followed the construction of Plato given by Aristotle. “It was improbable (he said) that Aristotle could be ignorant either what the word signified, or what was Plato’s purpose” (ἀλλὰ τῷ Ἀριστοτέλει, φησὶν, οὕτω λέγοντι ἴλλεσθαι, οὐκ εὖλογον ἀντιλέγειν· ὡς ἀληθῶς γὰρ οὔτε τῆς λέξεως τὸ σημαίνον ἐῖκος ἦν ἀγνοεῖν αὐτὸν, οὔτε τὸν Πλάτωνος σκοπόν. This passage is not given in the Scholia of Brandis). Alexander therefore construed εἰλλομένην as meaning or implying rotatory movement, though in so doing he perverted (so Simplicius says) the true meaning to make it consonant with his own suppositions.

Proklus maintains that Aristotle has interpreted the passage erroneously, — that εἰλλομένην is equivalent to σφιγγομένην or ξυνεχομένην — and that Plato intends by it to affirm the earth as at rest

in the centre of the Kosmos (ad Timaeum, Book iv., p. 681 ed. Schneider). Simplicius himself is greatly perplexed, and scarcely ventures to give a positive opinion of his own. On the whole, he inclines to believe that ἰλλομένην might possibly be understood, by superficial readers, so as to signify rotation, though such is not its proper and natural sense: that some Platonists did so misunderstand it: and that Aristotle accepted their sense for the sake of the argument, without intending himself to countenance it (ad Aristot. De Coelo, p. 126).

Both Proklus and Simplicius, we must recollect, believed in the genuineness of the Doric treatise ascribed to Timaeus Locrus. Reasoning upon this basis, they of course saw, that if Aristotle had correctly interpreted Plato, Plato himself must have interpreted *incorrectly* the doctrine of Timaeus. They had to ascribe wrong construction either to Plato or to Aristotle: and they could not bear to ascribe it to Plato.

Alkinous, in his Eisagôge (c. 15) gives the same interpretation as Proklus. But it is remarkable that in his paraphrase of the Platonic words, he calls the earth ἡμέρας φύλαξ καὶ νυκτός: omitting the significant epithet δημιουργός.

In regard to modern comments upon the same disputed point, I need only mention (besides those of M. Cousin, in the notes upon his translation of the ‘Timæus’, and of Martin in his ‘Études sur le Timée’) the elaborate discussion which it has received in the two recent Dissertations ‘Ueber die kosmischen Systeme der Griechen,’ by Gruppe and Boeckh. Gruppe has endeavoured, upon the evidence of this passage, supported by other collateral proofs, to show that Plato, towards the close of his life, arrived at a belief, first, in the rotation of the earth round its own axis, next, at the double movement of the earth, both rotation and translation, round the sun as a centre (that is, the heliocentric or Copernican system): that Plato was the first to make this discovery, but that he was compelled to announce it in terms intentionally equivocal and obscure, for fear of offending the religious sentiments of his contemporaries (‘Die kosmischen Systeme der Griechen, von O. F. Gruppe,’ Berlin, 1851). To this dissertation M. Boeckh — the oldest as well as the ablest of all living philologists — has composed an elaborate reply, with his usual fulness of illustrative matter and sobriety of inference. Opinions previously delivered by him (in his early treatises on the Platonic and Pythagorean philosophy) had been called in question by Gruppe: he has now re-asserted them and defended them at length, maintaining that Plato always held the earth to be stationary and the sidereal sphere rotatory — and answering or extenuating the arguments which point to an opposite conclusion (‘Untersuchungen über das kosmische System des Platon, von August Boeckh,’ Berlin, 1852).

Gruppe has failed in his purpose of proving that Plato adopted either of the two above-mentioned doctrines — either the rotation of the earth round its own axis, or the translation of the earth round the sun as a centre. On both these points I concur with Boeckh in the negative view. But though I go along with his reply as to its negative results, I cannot think it satisfactory in its positive aspect as an exposition of the doctrine proclaimed in the Platonic Timæus: nor can I admit that the main argument

of M. Boeckh's treatise is sufficient to support the inference which he rests upon it. Moreover, he appears to me to set aside or explain away too lightly the authority of Aristotle. I agree with Alexander of Aphrodisias and with Gruppe who follows him, in pronouncing Aristotle to be a good witness, when he declares what were the doctrines proclaimed in the Platonic *Timæus*; though I think that Gruppe has not accurately interpreted either *Timæus* or Aristotle.

The capital argument of Boeckh is as follows: "The Platonic *Timæus* affirms, in express and unequivocal terms, the rotation of the outer celestial sphere (the sidereal sphere or *Aplanes*) in twenty-four hours, as bringing about and determining the succession of day and night. Whoever believes this cannot at the same time believe that the earth revolves round its own axis in twenty-four hours, and that the succession of day and night is determined thereby. The one of these two affirmations excludes the other; and, as the first of the two is proclaimed, beyond all possibility of doubt, in the Platonic *Timæus*, so we may be sure that the second of the two cannot be proclaimed in that same discourse. If any passage therein seems to countenance it, we must look for some other mode of interpreting the passage."

This is the main argument of M. Boeckh, and also of Messrs. Cousin and Martin. The latter protests against the idea of imputing to Plato "un mélange monstrueux de deux systèmes incompatibles" (*Études sur le Timée*, vol. ii. p. 86-88).

As applied to any person educated in the modern astronomy, the argument is irresistible. But is it equally irresistible when applied to Plato and to Plato's time? I think not. The incompatibility which appears so glaring at present, did not suggest itself to him or to his contemporaries. To prove this we have only to look at the reasoning of Aristotle, who (in the treatise *De Cælo*, ii. 13-14, p. 293. b. 30, 296. a. 25) notices and controverts the doctrine of the rotation of the earth, with express reference to the followers of the Platonic *Timæus* — and who (if we follow the view of Martin) imputes this doctrine with wilful falsehood to Plato, for the purpose of contemptuously refuting it "pour se donner le plaisir de la réfuter avec dédain." Granting the view of M. Boeckh (still more that of Martin) to be correct, we should find Aristotle arguing thus:— "Plato affirms the diurnal rotation of the earth round the centre of the cosmical axis. This is both incredible, and incompatible with his own distinct affirmation that the sidereal sphere revolves in twenty-four hours. It is a glaring inconsistency that the same author should affirm both the one and the other." Such would have been Aristotle's reasoning, on the hypothesis which I am considering; but when we turn to his treatise we find that he does not employ this argument at all. He contests the alleged rotation of the earth upon totally different arguments — chiefly on the ground that rotatory motion is not natural to the earth, that the kind of motion natural to the earth is rectilinear, towards the centre; and he adds various corollaries flowing from this doctrine which I shall not now consider. At the close of his refutation, he states in general terms that the celestial appearances, as observed by scientific men, coincided with his doctrine.

Hence we may plainly see that Aristotle probably did not see the incompatibility, supposed to be so

glaring, upon which M. Boeckh's argument is founded. To say the least, even if he saw it, he did not consider it as glaring and decisive. He would have put it in the foreground of his refutation, if he had detected the gross contradiction upon which M. Boeckh insists. But Aristotle does not stand alone in this dulness of vision. Among the various commentators, ancient and modern, who follow him, discussing the question now before us, not one takes notice of M. Boeckh's argument. He himself certifies to us this fact, claiming the argument as his own, and expressing his astonishment that all the previous critics had passed it over, though employing other reasons much weaker to prove the same point. We read in M. Boeckh's second 'Commentatio de Platonico Systemate Cœlestium Globorum et de Verâ Indole Astronomiæ Philolaicæ,' Heidelberg, 1810, p. 9, the following words:—

“Non moveri tellurem, Proclus et Simplicius ostendunt ex Phædone. Parum firmum tamen argumentum est ex Phædone ductum ad interpretandum Timæi locum: nec melius alterum, quod Locrus Timæus, quem Plato sequi putabatur, terram stare affirmat: quia, ut nuper explicuimus, non Plato ex Locro, sed personatus Locrus ex Platone, sua compilavit. At omnium firmissimum et certissimum argumentum ex ipso nostro dialogo sumptum, *adhuc, quod jure mirere, nemo reperit*. Etenim, quum, paulo supra, orbem stellarum fixarum, quem Græci ἀπλανῆ appellat, dextrorsum ferri quotidiano motu Plato statuebat, non poterat ullum terræ motum admittere; quia, *qui hunc admittit, illum non tollere non potest*.” (This passage appears again cited by M. Boeckh himself in his more recent dissertation 'Untersuchungen über das kosmische System des Platon,' p. 11). The writers named (p. 7) as having discussed the question, omitting or disregarding this most cogent argument, are names extending from Aristotle down to Ruhnken and Ideler.

It is honourable to the penetration of M. Boeckh that he should have pointed out, what so many previous critics had overlooked, that these two opinions are scientifically incompatible. He wonders, and there may be good ground for wondering, how it happened that none of these previous writers were aware of the incompatibility. But the fact that it did not occur to them, is not the less certain, and is of the greatest moment in reference to the question now under debate; for we are not now inquiring what is or is not scientifically true or consistent, but what were the opinions of Plato. M. Boeckh has called our attention to the fact, that these two opinions are incompatible; but can we safely assume that Plato must have perceived such incompatibility between them? Surely not. The Pythagoreans of his day did not perceive it; their cosmical system included both the revolution of the earth and the revolution of the sidereal sphere round the central fire, ten revolving bodies in all (Aristotel. Metaphysic. i. 35, p. 96 a. 10. De Cœlo, ii. 13, p. 293 b. 21). They were not aware that the revolutions of the one annulled those of the other as to effect, and that their system thus involved the two contradictory articles, or “mélange monstrueux,” of which Martin speaks so disdainfully. Nay, more, their opponent, Aristotle, while producing other arguments against them, never points out the contradiction. Since it did not occur to them, we can have no greater difficulty in believing that neither did it occur to Plato. Indeed, the wonder would rather be if Plato *had* seen an astronomical incompatibility which escaped the notice both of Aristotle and of many subsequent writers who wrote

at a time when astronomical theories had been developed and compared with greater fulness. Even Ideler, a good astronomer as well as a good scholar, though he must surely have known that Plato asserted the rotation of the sidereal sphere (for no man can read the ‘Timæus’ without knowing it), ascribed to him also the other doctrine inconsistent with it, not noticing such inconsistency until M. Boeckh pointed it out.

It appears to me, therefore, that M. Boeckh has not satisfactorily made good his point — “Plato cannot have believed in the diurnal rotation of the earth, because he unquestionably believed in the rotation of the sidereal sphere as causing the succession of night and day.” For, though the two doctrines really are incompatible, yet the critics antecedent to M. Boeckh took no notice of such incompatibility. We cannot presume that Plato saw what Aristotle and other authors, even many writing under a more highly developed astronomy, did not see. We ought rather, I think, to presume the contrary, unless Plato’s words distinctly attest that he did see farther than his successors.

Now let us examine what Plato’s words do attest:— γῆν δὲ τροφὸν μὲν ἡμετέραν, εἰλλομένην (al. εἰλομένην, ἰλλομένην) δὲ περὶ τὸν διὰ παντὸς πόλον τεταμένον φύλακα καὶ δημιουργὸν νυκτός τε καὶ ἡμέρας ἐμηχανήσατο, πρῶτην καὶ πρεσβυτάτην θεῶν, ὅσοι ἐντὸς οὐράνου γεγόνασιν.

I explain these words as follows:—

In the passage immediately preceding, Plato had described the uniform and unchanging rotation of the outer sidereal sphere, or Circle of The Same, and the erratic movements of the sun, moon, and planets, in the interior Circles of the Diverse. He now explains the situation and functions of the earth. Being the first and most venerable of the intra-kosmic deities, the earth has the most important place in the interior of the kosmos — the centre. It is packed, fastened, or rolled, close round the axis which traverses the entire kosmos; and its function is to watch over and bring about the succession of night and day. *Plato conceives the cosmic axis itself as a solid cylinder revolving or turning round, and causing thereby the revolution of the circumference or the sidereal sphere.* The outer circumference of the kosmos not only revolves round its axis, but obeys a rotatory impulse emanating from its axis, like the spinning of a teetotum or the turning of a spindle. Plato in the Republic illustrates the cosmical axis by comparison with a spindle turned by Necessity, and describes it as causing by its own rotation the rotation of all the heavenly bodies (Republ. x. p. 616, c. 617 A). ἐκ δὲ τῶν ἄκρων τεταμένον Ἀνάγκης ἄτρακτον, δι’ οὗ πάσας ἐπιστρέφεσθαι τὰς περίφορας ..., κυκλεῖσθαι δὲ δὴ στρεφόμενον τὸν ἄτρακτον ὅλον μὲν τὴν αὐτὴν φοραν στρέφεσθαι δὲ αὐτὸν ἐν τοῖς Ἀνάγκης γόνασιν.¹

¹ Proklus in his Commentary on the Platonic Timæus (p. 682, Schn.) notes this passage of the Republic as the proper comparison from which to interpret how Plato conceived the cosmical axis. In many points he explains this correctly; but he omits to remark that the axis is expressly described as revolving, and as causing the revolution of the peripheral substance:—

— τὸν δὲ ἄξονα μίαν θεότητα συναγωγὸν μὲν τῶν κέντρων τοῦ παντός συνεκτικὴν δὲ τοῦ ὅλου κόσμου, κινητικὴν δὲ τῶν θείων περιφορῶν, περὶ ἣν ἡ χορεία τῶν ὅλων, περὶ ἣν αἱ ἀνακυκλήσεις, ἀνέχουσιν τὸν ὅλον οὐρανόν, ἣν καὶ Ἄτλαντα διὰ τοῦτο προσειρήκασιν, ὡς ἄτρεπτον καὶ ἄτρυτον ἐνέργειαν ἔχουσιν. καὶ μέντοι καὶ τὸ τεταμένον ἐνδείκνυται τιτήνιον εἶναι τὴν μίαν ταύτην δύναμιν, τὴν φρουρητικὴν τῆς ἀνακυκλήσεως τῶν ὅλων.

Here Proklus recognises the efficacy of the axis in producing and maintaining the revolution of the Kosmos, but he does not remark that it initiates this movement by revolving itself. The Θεότης, which Proklus ascribes to the axis, is invested in the earth packed round it, by the Platonic Timæus.

Now the function which Plato ascribes to the earth in the passage of the Timæus before us is very analogous to that which in the Republic he ascribes to Necessity — the active guardianship of the axis of the kosmos and the maintenance of its regular rotation. With a view to the exercise of this function, the earth is planted in the centre of the axis, the very root of the kosmic soul (Plato, Timæus, p. 34 B). It is even “packed close round the axis,” in order to make sure that the axis shall not be displaced from its proper situation and direction. The earth is thus not merely active and influential, but is really the chief regulator of the march of the kosmos, being the immediate neighbour and auxiliary of the kosmic soul. Such a function is worthy of “the first and eldest of intra-kosmic deities,” as Plato calls the earth. With perfect propriety he may say that the earth, in the exercise of such a function, “is guardian and artificer of day and night.” This is noway inconsistent with that which he says in another passage, that the revolutions of the outer sidereal sphere determine day and night. For these revolutions of the outer sidereal sphere depend upon the revolutions of the axis, which latter is kept in uniform position and movement by the earth grasping it round its centre and revolving with it. The earth does not determine days and nights by means of its own rotations, but by its continued influence upon the rotations of the kosmic axis, and (through this latter) upon those of the outer sidereal sphere.

It is important to attend to the circumstance last mentioned, and to understand in what sense Plato admitted a rotatory movement of the earth. In my judgment, the conception respecting the earth and its functions, as developed in the Platonic Timæus, has not been considered with all its points taken together. One point among several, and that too the least important point, has been discussed as if it were the whole, because it falls in with the discussions of subsequent astronomy. Thus Plato admits the rotation of the earth, but he does not admit it as producing any effects, or as the primary function of the earth: it is only an indirect consequence of the position which the earth occupies in the discharge of its primary function — of keeping the cosmical axis steady, and maintaining the uniformity of its rotations. If the cosmical axis is to revolve, the earth, being closely packed and fastened round it, must revolve along with it. If the earth stood still, and resisted all rotation of its own, it would at the same time arrest the rotations of the cosmical axis, and of course those of the

entire kosmos besides.

The above is the interpretation which I propose of the passage in the Platonic Timæus, and which I shall show to coincide with Aristotle's comment upon it. Messrs. Boeckh and Martin interpret differently. They do not advert to the sense in which Plato conceives the axis of the kosmos — not as an imaginary line, but as a solid revolving cylinder; and moreover they understand the function assigned by the Platonic Timæus to the earth in a way which I cannot admit. They suppose that the function assigned to the earth is not to keep up and regularize, but to withstand and countervail, the rotation of the kosmos. M. Boeckh comments upon Gruppe, who had said (after Ideler) that when the earth is called φύλακα καὶ δημιουργὸν νυκτὸς καὶ ἡμέρας, Plato must have meant to designate some active function ascribed to it, and not any function merely passive or negative. I agree with Gruppe in this remark, and I have endeavoured to point out what this active function of the earth is, in the Platonic theory. But M. Boeckh (Untersuchungen, &c., p. 69-70) controverts Gruppe's remark, observing, first, that it is enough if the earth is in any way necessary to the production of the given effect; secondly, that if active force be required, the earth (in the Platonic theory) does exercise such, by its purely passive resistance, which is in itself an energetic putting forth of power.

M. Boeckh's words are:— “Es kommt nur darauf an, dass er ein Werk, eine Wirkung, hervorbringt oder zu einer Wirkung beiträgt, die ohne ihn nicht wäre: dann ist er durch seine Wirksamkeit ein Werkmeister der Sache, sey es auch ohne active Thätigkeit, durch bloss passiven Widerstand, der auch eine mächtige Kraft-äusserung ist. Die Erde ist Werkmeisterin der Nacht und des Tages, wie Martin (b. ii. p. 88) sehr treffend sagt ‘par son énergique existence, c’est à dire, par son immobilité même:’ denn sie setzt der täglichen Bewegung des Himmels beständig eine gleiche Kraft in entgegengesetzter Richtung entgegen. So *muss* nach dem Zusammenhange ausgelegt werden: so meint es Platon klar und ohne Verhüllungen: denn wenige Zeilen vorher hat er gesagt, Nacht und Tag, das heisst ein Sterntag oder Zeittag, sei ein Umlauf des Kreises des Selbigen — *das ist, eine tägliche Umkreisung des Himmels von Osten nach Westen, wodurch also die Erde in Stillstand versetzt ist:* und diese tägliche Bewegung des Himmels hat er im vorhergehenden immer und immer gelehrt.” . . . “Indem Platon die Erde nennt εἰλομένην, nicht περὶ τὸν ἑαυτῆς πόλον, sondern περὶ τὸν διὰ παντὸς πόλον τεταμένον, setzt er also die tägliche Bewegung des Himmels voraus” (p. 70-71).²

² “We are only required to show, that the Earth produces a work or an effect, — or contributes to an effect which would not exist without such help: the Earth is then, through such operation, an *Artificer* of what is produced, even without any positive activity, by its simply passive resistance, which indeed is in itself a powerful exercise of force. The Earth is Artificer of night and day, according to the striking expression of Martin, ‘par son énergique existence, c’est-à-dire, par son immobilité même:’ for the Earth opposes, to the diurnal movement of the Heavens, a constant and equal force in the opposite direction. This explanation *must* be the true one required by the context: this is Plato's meaning, plainly and

without disguise: for he has said, a few lines before, that Night and Day (that is, a sidereal day, or day of time) is a diurnal revolution of the Heaven from East to West, whereby accordingly the Earth is assumed as at rest: And this diurnal movement of the Heaven he has taught over and over again in the preceding part of his discourse.” — “Since therefore Plato calls the Earth εἰλομένην, not περὶ τὸν ἑαυτῆς πόλον, but περὶ τὸν διὰ παντὸς πόλον τεταμένον, he implies thereby the diurnal movement of the Heaven.”

I not only admit but put it in the front of my own case, that Plato in the Timæus assumes the diurnal movement of the celestial sphere; but I contend that he also assumes the diurnal rotation of the earth. M. Boeckh founds his contrary interpretation upon the unquestionable truth that these two assumptions are inconsistent; and upon the inference that because the two cannot stand together in fact, therefore they cannot have stood together in the mind of Plato. In that inference I have already stated that I cannot acquiesce.

But while M. Boeckh takes so much pains to vindicate Plato from one contradiction, he unconsciously involves Plato in another contradiction, for which, in my judgment, there is no foundation whatever. M. Boeckh affirms that the function of the earth (in the Platonic Timæus) is to put forth a great force of passive resistance — “to oppose constantly, against the diurnal movement of the heavens, an equal force in an opposite direction.” Is it not plain, upon this supposition, that the kosmos would come to a standstill, and that its rotation would cease altogether? As the earth is packed close or fastened round the cosmical axis, so, if the axis endeavours to revolve with a given force, and the earth resists with equal force, the effect will be that the two forces will destroy one another, and that neither the earth nor the axis will move at all. There would be the same nullifying antagonism as if, — reverting to the analogous case of the spindle and the verticilli (already alluded to) in the tenth book of the Republic, — as if, while Ananké turned the spindle with a given force in one direction, Klotho (instead of lending assistance) were to apply her hand to the outermost verticillus with equal force of resistance in the opposite direction (see Reipubl. x. p. 617 D). It is plain that the spindle would never turn at all.

Here, then, is a grave contradiction attaching to the view of Boeckh and Martin as to the function of the earth. They have not, in my judgment, sufficiently investigated the manner in which Plato represents to himself the cosmical axis: nor have they fully appreciated what is affirmed or implied in the debated word εἰλόμενον — εἰλούμενον — ἰλλόμενον. That word has been explained partly by Ruhnken in his notes on Timæi Lexicon, but still more by Buttmann in his Lexilogus, so accurately and copiously as to leave nothing further wanting. I accept fully the explanation given by Buttmann, and have followed it throughout this article. After going over many other examples, Buttmann comes to consider this passage of the Platonic Timæus; and he explains the word εἰλομένην or ἰλλόμενην as meaning — “*sich drängen oder gedrängt werden um die Axe: d. h. von allen Seiten her an die Axe.* Auch lasse man sich das Praesens nicht irren: die Kräfte, welche den Weltbau machen und zusammen

halten, sind als fortdauernd thätig gedacht. Die Erde drängt sich (ununterbrochen) an den Pol, *macht, bildet eine Kugel um ihn*. Welcher Gebrauch völlig entspricht dem wonach dasselbe Verbum ein *einwickeln, einhüllen*, bedeutet. Auch hier mengt sich in der Vorstellung einiges hinzu, was auf ein *biegen winden*, und mitunter auf ein *drehen* führt: was aber *überall nur ein durch die Sache selbst hinzutretender Begriff ist*,” p. 151. And again, p. 154, he gives the result — that the word has only “die Bedeutung *drängen, befestigen*, nebst den davon ausgehenden — die von *drehen, winden*, aber ihm *gänzlich fremd* sind, und nur aus der Natur der Gegenstände in einigen Fällen als Nebengedanken hinzutreten.”³

³ “To *pack itself*, or to *be packed*, round the axis: that is, upon the axis from all sides. We must not be misled by the present tense: for the forces, which compose and hold together the structure of the universe, are conceived as continuously in active operation. The Earth *packs itself*, or *is packed*, on to the axis — *makes or forms a ball round the axis*: which corresponds fully to that other usage of the word, in the sense of *wrapping up* or *swathing round*. Here too there is a superadded something blended with the idea, which conducts us to *turning, winding*, and thus to *revolving*: but this is every where nothing more than an accessory notion, suggested by the circumstances of the case. The word has only the meaning, to *pack*, to *fasten* — the senses, to *wind*, to *revolve*, are altogether foreign to it, and can only be superadded as accessory ideas, in certain particular instances, by the special nature of the case.”

In these last words Buttmann has exactly distinguished the true, constant, and essential meaning of the word, from the casual accessories which become conjoined with it by the special circumstances of some peculiar cases. The constant and true meaning of the word is, *being packed or fastened close round, squeezing or grasping around*. The idea of *rotating* or *revolving* is quite foreign to this meaning, but may nevertheless become conjoined with it, in certain particular cases, by accidental circumstances.

Let us illustrate this. When I say that a body *A* is εἰλόμενον or ἰλλόμενον (packed or fastened close round, squeezing or grasping around), another body *B*, I affirm nothing about revolution or rotation. This is an idea foreign to the proposition *per se*, yet capable of being annexed or implicated with it under some accidental circumstances. Whether in any particular case it be so implicated or not depends on the question “What is the nature of the body *B*, round which I affirm *A* to be fastened?” 1. It may be an oak tree or a pillar, firmly planted and stationary. 2. It may be some other body, moving, but moving in a rectilinear direction. 3. Lastly, it may be a body rotating or intended to rotate, like a spindle, a spit, or the rolling cylinder of a machine. In the first supposition, all motion is excluded: in the second, rectilinear motion is implied, but rotatory motion is excluded: in the third, rotatory motion is implied as a certain adjunct. The body which is fastened round another, must share the motion or the rest of that other. If the body *B* is a revolving cylinder, and if I affirm that *A* is packed

or fastened close round it, I introduce the idea of rotation; though only as an accessory and implied fact, in addition to that which the proposition affirms. The body *A*, being fastened round the cylinder *B*, must either revolve along with it and round it, or it must arrest the rotation of *B*. If the one revolves, so must the other; both must either revolve together, or stand still together. This is a new fact, distinct from what is affirmed in the proposition, yet implied in it or capable of being inferred from it through induction and experience.

Here we see exactly the position of Plato in regard to the rotation of the earth. He does not affirm it in express terms, but he affirms what implies it. For when he says that the earth is packed, or fastened close round the cosmical axis, he conveys to us by implication the knowledge of another and distinct fact — that the earth and the cosmical axis must either revolve together or remain stationary together — that the earth must either revolve along with the axis or arrest the revolutions of the axis. It is manifest that Plato does not mean the revolutions of the axis of the kosmos to be arrested: they are absolutely essential to the scheme of the *Timæus* — they are the grand motive-agency of the kosmos. He must, therefore, mean to imply that the earth revolves along with and around the cosmical axis. And thus the word εἰλόμενον or ἰλλόμενον, according to Buttmann's doctrine, becomes accidentally conjoined, through the specialities of this case, with an accessory idea of rotation or revolution; though that idea is foreign to its constant and natural meaning.

Now if we turn to Aristotle, we shall find that he understood the word εἰλόμενον or ἰλλόμενον, and the proposition of Plato, exactly in this sense. Here I am compelled to depart from Buttmann, who affirms (p. 152), with an expression of astonishment, that Aristotle misunderstood the proposition of Plato, and interpreted εἰλόμενον or ἰλλόμενον as if it meant directly as well as incontestably, *rotating* or *revolving*. Proklus, in his *Commentary on the Timæus*, had before raised the same controversy with Aristotle — ἰλλομένην δὲ, τὴν σφιγγομένην δηλοῖ καὶ συνεχομένην οὐ γὰρ ὡς Ἀριστοτέλης οἶεται, τὴν κινουμένην (Procl. p. 681). Let us, therefore, examine the passages of Aristotle out of which this difficulty arises.

The passages are two, both of them in the second book *De Cælo*; one in cap. 13, the other in cap. 14 (p. 293 b. 30, 296 a. 25).

1. The first stands — ἔνιοι δὲ καὶ κειμένην (τὴν γῆν) ἐπὶ τοῦ κέντρου φασὶν αὐτὴν ἴλλεσθαι περὶ τὸν διὰ παντὸς τεταμένον πόλον, ὥσπερ ἐν τῷ Τιμαίῳ γέγραπται. Such is the reading of Bekker in the Berlin edition: but he gives various readings of two different MSS. — the one having ἴλλεσθαι καὶ κινεῖσθαι — the other εἰλεῖσθαι καὶ κινεῖσθαι.

2. The second stands, beginning chap. 14 — ἡμεῖς δὲ λέγωμεν πρῶτον πότερον (the earth) ἔχει κίνησιν ἢ μένει· καθάπερ γὰρ εἵπομεν, οἱ μὲν αὐτὴν ἐν τῶν ἄστρον ποιοῦσιν, οἱ δ' ἐπὶ τοῦ μέσου θέντες ἴλλεσθαι καὶ κινεῖσθαι φασι περὶ τὸν πόλον μέσον.

Now, in the first of these two passages, where Aristotle simply brings the doctrine to view without

any comment, he expressly refers to the *Timæus*, and therefore quotes the expression of that dialogue without any enlargement. He undoubtedly understands the affirmation of Plato — that the earth was fastened round the cosmical axis — as implying that it rotated along with the rotations of that axis. Aristotle thus construes ἵλλεσθαι, *in that particular proposition* of the *Timæus*, as implying rotation. But he plainly did not construe ἵλλεσθαι as naturally and constantly either denoting or implying rotation. This is proved by his language in the second passage, where he reproduces the very same doctrine with a view to discuss and confute it, and without special reference to the Platonic *Timæus*. Here we find that he is not satisfied to express the doctrine by the single word ἵλλεσθαι. He subjoins another verb — ἵλλεσθαι καὶ κινεῖσθαι: thus bringing into explicit enunciation the fact of rotatory movement, which, while ἵλλεσθαι stood alone, was only known by implication and inference from the circumstances of the particular case. If he had supposed ἵλλεσθαι by itself to signify *revolving* the addition of κινεῖσθαι would have been useless, unmeaning, and even impertinent. Aristotle, as Boeckh remarks, is not given to multiply words unnecessarily.

It thus appears, when we examine the passages of Aristotle, that he understood ἵλλεσθαι quite in conformity with Buttmann's explanation. Rotatory movement forms no part of the meaning of the word; yet it may accidentally, in a particular case, be implied as an adjunct of the meaning, by virtue of the special circumstances of that case. Aristotle describes the doctrine as held by *some persons*. He doubtless has in view various Platonists of his time, who adopted and defended what had been originally advanced by Plato in the *Timæus*.

M. Boeckh, in a discussion of some length (Untersuch. p. 76-84), maintains the opinion that the reading in the first passage of Aristotle is incorrect; that the two words ἵλλεσθαι καὶ κινεῖσθαι ought to stand in the first as they do in the second, — as he thinks that they stood in the copy of Simplikios: that Aristotle only made reference to Plato with a view to the peculiar word ἵλλεσθαι, and not to the general doctrine of the rotation of the earth: that he comments upon this doctrine as held by others, but not by Plato — who (according to Boeckh) was known by everyone not to hold it. M. Boeckh gives this only as a conjecture, and I cannot regard his arguments in support of it as convincing. But even if he had convinced me that ἵλλεσθαι καὶ κινεῖσθαι were the true reading in the first passage, as well as in the second, I should merely say that Aristotle had not thought himself precluded by the reference to the *Timæus* from bringing out into explicit enunciation what the Platonists whom he had in view knew to be implied and intended by the passage. This indeed is a loose mode of citation, which I shall not ascribe to Aristotle without good evidence. In the present case such evidence appears to me wanting.⁴

4 Exactness of citation is not always to be relied on among ancient commentators. Simplikios cites this very passage of the *Timæus* with more than one inaccuracy. — (ad Aristot. *De Coelo*, fol. 125.)

M. Martin attributes to Aristotle something more than improper citation. He says (*Études sur le Timée*, vol. ii. p. 87), “Si Aristote citait l’opinion de la rotation de la terre comme un titre de gloire pour Platon, je dirais — il est probable que la vérité l’y a forcé. Mais Aristote, qui admettait l’immobilité complète de la terre, attribue à Platon l’opinion contraire, *pour se donner le plaisir de la réfuter avec dédain*.” A few lines before, M. Martin had said that the arguments whereby Aristotle combated this opinion ascribed to Plato were “very feeble.” I am at a loss to imagine in which of Aristotle’s phrases M. Martin finds any trace of disdain or contempt, either for the doctrine or for those who held it. For my part, I find none. The arguments of Aristotle against the doctrine, whatever be their probative force, are delivered in that brief, calm, dry manner which is usual with him, without a word of sentiment or rhetoric, or anything ἔξω τοῦ πράγματος. Indeed, among all philosophers who have written much, I know none who is less open to the reproach of mingling personal sentiment with argumentative debate than Aristotle. Plato indulges frequently in irony, or sneering, or rhetorical invective; Aristotle very rarely. Moreover, even apart from the question of contempt, the part which M. Martin here assumes Aristotle to be playing, is among the strangest anomalies in the history of philosophy. Aristotle holds, and is anxious to demonstrate, the doctrine of the earth’s immobility; he knows (so we are required to believe) that Plato not only holds the same doctrine, but has expressly affirmed it in the *Timæus*: he might have produced Plato as an authority in his favour, and the passage of the *Timæus* as an express declaration; yet he prefers to pervert, knowingly and deliberately, the meaning of this passage, and to cite Plato as a hostile instead of a friendly authority — simply “to give himself the pleasure of contemptuously refuting Plato’s opinion!” But this is not all. M. Martin tells us that the arguments which Aristotle produces against the doctrine are, after all, very feeble. But he farther tells us that there was one argument which might have been produced, and which, if Aristotle had produced it, would have convicted Plato of “an enormous contradiction” (p. 88) in affirming that the earth revolved round the cosmical axis. Aristotle might have said to Plato — “You have affirmed, and you assume perpetually throughout the *Timæus*, the diurnal revolution of the outer sidereal sphere; you now assert the diurnal revolution of the earth at the centre. Here is an enormous contradiction; the two cannot stand together.” — Yet Aristotle, having this triumphant argument in his hands, says not a word about it, but contents himself with various other arguments which M. Martin pronounces to be very feeble.

Perhaps M. Martin might say — “The contradiction exists; but Aristotle was not sharp-sighted enough to perceive it; otherwise he would have advanced it.” I am quite of this opinion. If Aristotle had perceived the contradiction, he would have brought it forward as the strongest point in his controversy. His silence is to me a proof that he did not perceive it. But this is a part of my case against M. Martin. I believe that Plato admitted both the two contradictory doctrines without

perceiving the contradiction; and it is a strong presumption in favour of this view that Aristotle equally failed to perceive it — though in a case where, according to M. Martin, he did not scruple to resort to dishonest artifice.

It appears to me that the difficulties and anomalies, in which we are involved from supposing that Aristotle either misunderstood or perverted the meaning of Plato — are far graver than those which would arise from admitting that Plato advanced a complicated theory involving two contradictory propositions, in the same dialogue, without perceiving the contradiction; more especially when the like failure of perception is indisputably ascribable to Aristotle — upon every view of the case.

M. Cousin maintains the same interpretation of the Platonic passage as Boeckh and Martin, and defends it by a note on his translation of the *Timæus* (p. 339). The five arguments which he produces are considered both by himself and by Martin to be unanswerable. As he puts them with great neatness and terseness, I here bestow upon them a separate examination.

1. “Platon a toujours été considéré dans l’antiquité comme partisan de l’immobilité absolue de la terre.” M. Cousin had before said, “Aristote se fonde sur ce passage pour établir que Platon a fait tourner la terre sur elle-même: mais Aristote est, dans l’antiquité, le seul qui soutienne cette opinion.”

My reply is, that Aristotle is himself a portion and member of antiquity, and that the various Platonists, whom he undertakes to refute, are portions of it also. If M. Cousin appeals to the authority of antiquity, it must be to antiquity, not merely *minus* Aristotle and these contemporary Platonists, but *against* them. Now these are just the witnesses who had the best means of knowledge. Besides which, Aristotle himself, adopting and anxious to demonstrate the immobility of the earth, had every motive to cite Plato as a supporter, if Plato was such — and every motive to avoid citing Plato as an opponent, unless the truth of the case compelled him to do so. I must here add, that M. Cousin represents Aristotle as ascribing to Plato the doctrine that “la terre tourne sur elle-même.” This is not strictly exact. Aristotle understands the Platonic *Timæus* as saying, “That the earth is packed and moved *round the axis of the kosmos*” — a different proposition.

2. “Dans plusieurs endroits de ses ouvrages où Platon parle de l’équilibre de la terre, il ne dit pas un mot de sa rotation.”

I know of only *one* such passage — *Phædon*, p. 108 — where undoubtedly Plato does not speak of the rotation of the earth; but neither does he speak of the rotation of the sidereal sphere and of the kosmos — nor of the axis of the kosmos. It is the figure and properties of the earth, considered in reference to mankind who inhabit it, that Plato sketches in the *Phædon*; he takes little notice of its cosmical relations, and gives no general theory about the kosmos. M. Cousin has not adverted to the tenth Book of the *Republic*, where Plato does propound a cosmical theory, expressly symbolising the axis of the kosmos with its rotatory functions.

3. “Si la terre suit le mouvement de l’axe du monde, le mouvement de la huitième sphère, qui est Le

Même, devient nul par rapport à elle, et les étoiles fixes, qui appartiennent à elle, demeurent en apparence dans une immobilité absolue: ce qui est contraire à *l'expérience et au sens commun*, et à l'opinion de Platon, exprimée dans ce même passage.”

This third argument of M. Cousin is the same as that which I have already examined in remarking upon M. Boeckh. The diurnal rotation of the earth cannot stand in the same astronomical system with the diurnal rotation of the sidereal sphere. Incontestably true (I have already said) as a point of science. But the question here is, not what opinions are scientifically consistent, but what opinions were held by Plato, and whether he detected the inconsistency between the two. I have shown grounds for believing that he did not — and not he alone, but many others along with him, Aristotle among the number. How, indeed, can this be denied, when we find M. Boeckh announcing that he is the *first* among all the critics on the *Timæus*, who has brought forward the inconsistency as a special ground for determining what Plato's opinion was — that no other critic before him had noticed it?

The first words of this argument deserve particular attention, “Si la terre suit le mouvement de l'axe du monde.” Here we have an exact recital of the doctrine proclaimed by the Platonic *Timæus*, and ascribed to him by Aristotle (quite different from the doctrine “que la terre tourne sur elle-même”). M. Cousin here speaks very distinctly about the cosmical axis, and about its movement; thus implying that Plato conceived it as a solid revolving cylinder. This, in my judgment, is the most essential point for clearing up the question in debate. The cosmical axis being of this character, when Plato affirms that the earth is *packed or fastened round it* (*se roule* — Cousin: *se serre et s'enroule* — Martin: *drängt sich, macht eine Kugel um ihn* — Buttmann), I maintain that, in the plainest construction of the word, the earth does and must follow the movement of the axis — or arrest the movement of the axis. The word *εἰλομένην* or *ἰλλομένην* has no distinct meaning at all, if it does not mean this. The very synonyms (*σφιγγομένην, περιδεδεμένην, &c.*), which the commentators produce to prove that Plato describes the earth as at rest, do really prove that he describes it as rotating round and with the cosmical axis. We ought not to be driven from this plain meaning of the word, by the assurance of M. Cousin and others that Plato cannot have meant so, because it would involve him in an astronomical inconsistency.

4. “Les divers mouvemens des huit sphères expliquent toutes les apparences célestes; il n'y a donc aucune raison pour donner un mouvement à la terre.”

The terms of this fourth argument, if literally construed, would imply that Plato had devised a complete and satisfactory astronomical theory. I pass over this point, and construe them as M. Cousin probably intended: his argument will then stand thus — “The movement of the earth does not add anything to Plato's power of explaining astronomical appearances; therefore Plato had no motive to suggest a movement of the earth.”

I have already specified the sense in which I understand the Platonic *Timæus* to affirm, or rather to imply, the rotation of the earth; and that sense is not open to the objections raised in M. Cousin's

fourth and fifth arguments. The rotation of the earth, as it appears in the Platonic *Timæus*, explains nothing, and is not intended to explain anything. It is a consequence, not a cause: it is a consequence arising from the position of the earth, as packed or fastened round the centre of the cosmical axis, whereby the earth participates, of necessity and as a matter of course, in the movements of that axis. The *function* of the earth, thus planted in the centre of the kosmos, is to uphold and regulate the revolutions of the cosmical axis; and this function explains, in the scheme of the Platonic *Timæus*, why the axis revolves uniformly and constantly without change or displacement. Now upon these revolutions of the cosmical axis all the revolutions of the exterior sphere depend. This is admitted by M. Cousin himself in argument 3. There is therefore every reason why Plato should assign such regulating function to the earth, the “first and oldest of intra-kosmic deities.” The movement of the earth (as I before observed) is only an incidental consequence of the position necessary for the earth to occupy in performing such function.

5. “Enfin Platon assigne un mouvement aux étoiles fixes, et deux mouvemens aux planètes; puisqu’il ne range la terre ni avec les unes ni avec les autres, il y a lieu de croire qu’elle ne participe à aucun de leurs mouvemens.”

In so far as this argument is well-founded, it strengthens my case more than that of M. Cousin. The earth does not participate in the movements either of the fixed stars or of the planets; but it does participate in the revolutions of the cosmical axis, upon which these movements depend — the movements of the outer sphere, wholly and exclusively — the movements of the planets, to a very great degree, but not exclusively. The earth is not ranked either among the fixed stars or among the planets; it is a body or deity *sui generis*, having a special central function of its own, to regulate that cosmical axis which impels the whole system. The earth has a motion of its own, round and along with the cosmical axis to which it is attached; but this motion of the earth (I will again repeat, to prevent misapprehension) is a fact not important by itself, nor explaining anything. The grand and capital fact is the central position and regulating function of the earth, whereby all the cosmical motions, first those of the axis, next those of the exterior kosmos, are upheld and kept uniform.

M. Cousin adds, as a sixth argument:—

“On peut ajouter à ces raisons que Platon aurait nécessairement insisté sur le mouvement de la terre, s’il l’avait admis; et que ce point étoit trop controversé de son temps et trop important en lui-même, pour qu’il ne fût que l’indiquer en se servant d’une expression équivoque.”

In the first place, granting Plato to have believed in the motion of the earth, can we also assume that he would necessarily have asserted it with distinctness and emphasis, as M. Cousin contends? I think not. Gruppe maintains exactly the contrary; telling us that Plato’s language was intentionally obscure and equivocal — from fear of putting himself in open conflict with the pious and orthodox sentiment prevalent around him. I do not carry this part of the case so far as Gruppe, but I admit that it rests upon a foundation of reality. When we read (Plutarch, *De Facie in Orbe Lunæ*, p. 923) how the motion

of the earth, as affirmed by Aristarchus of Samos (doubtless in a far larger sense than Plato ever imagined, including both rotation and translation), was afterwards denounced as glaring impiety, we understand the atmosphere of religious opinion with which Plato was surrounded. And we also perceive that he might have reasons for preferring to indicate an astronomical heresy in terms suitable for philosophical hearers, rather than to proclaim it in such emphatic unequivocal words, as might be quoted by some future Melêtus in case of an indictment before the Dikasts.

We must remember that Plato had been actually present at the trial of Sokrates. He had heard the stress laid by the accusers on astronomical heresies, analogous to those of Anaxagoras, which they imputed to Sokrates — and the pains taken by the latter to deny that he held such opinions (see the Platonic Apology). The impression left by such a scene on Plato's mind was not likely to pass away: nor can we be surprised that he preferred to use propositions which involved and implied, rather than those which directly and undisguisedly asserted, the heretical doctrine of the earth's rotation. That his phraseology, however indirect, was perfectly understood by contemporary philosophers, both assentient and dissentient, as embodying his belief in the doctrine — is attested by the two passages of Aristotle.

Upon these reasons alone I should dissent from M. Cousin's sixth argument. But I have other reasons besides. He rests it upon the two allegations that the doctrine of the earth's motion was the subject of much controversial debate in Plato's time, and of great importance in itself. Now the first of these two allegations can hardly be proved, as to the time of Plato; for Aristotle, when he is maintaining the earth's immobility, does not specify any other opponents than the Pythagoreians and the followers of the Platonic Timæus. And the second allegation I believe to be unfounded, speaking with reference to the Platonic Timæus. In the cosmical system therein embodied, the rotation of the earth round the cosmical axis, though a real part of the system, was in itself a fact of no importance, and determining no results. The capital fact of the system was the position and function of the earth, packed close round the centre of the cosmical axis, and regulating the revolutions of that axis. Plato had no motive to bring prominently forward the circumstance that the earth revolved itself along with the cosmical axis, which circumstance was only an incidental accompaniment.

I have thus examined all the arguments adduced by M. Cousin, and have endeavoured to show that they fail in establishing his conclusion. There is, however, one point of the controversy in which I concur with him more than with Boeckh and Martin. This point is the proper conception of what Plato means by the *cosmical axis*. Boeckh and Martin seem to assume this upon the analogy of what is now spoken of as the axis of the earth: M. Boeckh (p. 13) declares the axis of the kosmos to be a prolongation of that axis. But it appears to me (and M. Cousin's language indicates the same) that Plato's conception was something very different. The axis of the earth (what astronomers speak of as such) is an imaginary line traversing the centre of the earth; a line round which the earth revolves. Now the cosmical axis, as Plato conceives it, is a solid material cylinder, which not only itself revolves, but causes by this revolution the revolution of the exterior circumference of the kosmos.

This is a conception entirely different from that which we mean when we speak of the axis of the earth. It is, however, a conception symbolically enunciated in the tenth book of the Republic, where the spindle of Necessity is said to be composed of adamant, hard and solid material, and to cause by its own rotation the rotation of all the *verticilli* packed and fastened around it. What is thus enunciated in the Republic is implied in the Timæus. For when we read therein that the earth is packed or fastened round the cosmical axis, how can we understand it to be packed or fastened round an imaginary line? I will add that the very same meaning is brought out in the translation of Cicero — “*trajecto axe sustinetur*” (terra). The axis, round which the earth is fastened, and which sustains the earth, must be conceived, not as an imaginary line, but as a solid cylinder, itself revolving; while the earth, being fastened round it, revolves round and along with it. The axis, in the sense of an imaginary line, cannot be found in the conception of Plato.

Those contemporaries of Plato and Aristotle, who all agreed in asserting the revolution of the celestial sphere, did not all agree in their idea of the force whereby such revolution was brought about. Some thought that the poles of the celestial sphere exercised a determining force: others symbolised the mythical Atlas, as an axis traversing the sphere from pole to pole and turning it round. (Aristotel. De Motu Animal. 3. p. 699 a. 15-30.) Aristotle himself advocated the theory of a *primum movens immobile* acting upon the sphere from without the sphere. Even in the succeeding centuries, when astronomy was more developed, Aratus, Eratosthenes, and their commentators, differed in their way of conceiving the cosmical axis. Most of them considered it as solid: but of these, some thought it was stationary, with the sphere revolving round it — others that it revolved itself: again, among these latter, some believed that the revolutions of the axis determined those of the surrounding sphere — others, that the revolutions of the sphere caused those of the axis within it. Again, there were some physical philosophers who looked at the axis as airy or spiritual — τὸ διὰ μέσου τῆς σφαίρας διῆκον πνεῦμα. Then there were geometers who conceived it only as an imaginary line. (See the Phaenomena of Aratus 20-25 — with the Scholia thereon; Achilles Tatius ad Arati Phaenom. apud Petavium — Uranolog. p. 88; also Hipparchus ad Arat. ib. p. 144.) I do not go into these dissentient opinions farther than to show, how indispensable it is, when we construe the passage in the Platonic Timæus, περὶ τὸν διὰ παντὸς πόλον τεταμένον, to enquire in what sense Plato understood the cosmical axis: and how unsafe it is to assume at once that he must have conceived it as an imaginary line.

Proklus argues that because the earth is mentioned by Plato in the Phædon as stationary in the centre of the heaven, we cannot imagine Plato to affirm its rotation in the Timæus. I agree with M. Boeckh in thinking this argument inconclusive; all the more, because, in the Phædon, not a word is said either about the axis of the kosmos, or about the rotation of the kosmos; all that Sokrates professes to give is τὴν ἰδέαν τῆς γῆς καὶ τοὺς τόπους αὐτῆς (p. 108 E). No cosmical system or theory is propounded in that dialogue.

When we turn to the Phædrus, we find that, in its highly poetical description, the rotation of the heaven occupies a prominent place. The internal circumference of the heavenly sphere, as well as its

external circumference or back (νῶτον), are mentioned; also its periodical rotations, during which the gods are carried round on the back of the heaven, and contemplate the eternal Ideas occupying the super-celestial space (p. 247, 248), or the plain of truth.⁵ But the purpose of this poetical representation appears to be metaphysical and intellectual, to illustrate the antithesis presented by the world of Ideas and Truth on one side — against that of sense and appearances on the other. Astronomically and cosmically considered, no intelligible meaning is conveyed. Nor can we even determine whether the rotations of the heaven, alluded to in the Phædrus, are intended to be diurnal or not; I incline to believe not (μέχρι τῆς ἑτέρας περιόδου — p. 248 — which can hardly be understood of so short a time as one day). Lastly, nothing is said in the Phædrus about the cosmical axis; and it is upon this that the rotations of the earth intimated in the Timæus depend.

⁵ Whether Ἑστία in the Phædrus, which is said “to remain alone stationary in the house of the Gods,” can be held to mean the Earth, is considered by Proklus to be uncertain (p. 681).

Among the different illustrations, given by Plato in his different dialogues respecting the terrestrial and celestial bodies, I select the tenth book of the Republic as that which is most suitable for comparison with the Timæus, because it is only therein that we learn how Plato conceived the axis of the kosmos. M. Boeckh (Untersuchungen, p. 86) wishes us to regard the difference between the view taken in the Phædon, and that in the Republic, as no way important; he affirms that the adamantine spindle in the Republic is altogether mythical or poetical, and that Plato conceives the axis as not being material. On this point I dissent from M. Boeckh. The mythical illustrations in the tenth book of the Republic appear to me quite unsuitable to the theory of an imaginary, stationary, and immaterial axis. Here I much more agree with Gruppe (p. 15, 26-29), who recognises the solid material axis as an essential feature of the cosmical theory in the Republic; and recognises also the marked difference between that theory and what we read in the Phædon. Yet, though Gruppe is aware of this important difference between the Republic and the Phædon, he still wishes to illustrate the Timæus by the latter and not by the former. He affirms that the earth in the Timæus is conceived as unattached, and freely suspended, the same as in the Phædon; but that in the Timæus it is conceived, besides, as revolving on its own axis, which we do not find in the Phædon (p. 28, 29). Here I think Gruppe is mistaken. In construing the words of Timæus, εἰλομένην (ἰλλομένην) περὶ τὸν διὰ παντὸς πόλον τεταμένον, as designating “the unattached earth revolving round its own axis,” he does violence not less to the text of Plato than to the expository comment of Aristotle. Neither in the one nor the other is anything said about *an axis of the earth*; in both, the cosmical axis is expressly designated; and, if Gruppe is right in his interpretation of εἰλομένην, we must take Plato as affirming, not that the earth is fastened round the cosmical axis, but that it revolves, though unattached, around that axis, which is a proposition both difficult to understand, and leading to none of those astronomical consequences with which Gruppe would connect it. Again, when Gruppe says that εἰλομένην περὶ does *not* mean *packed or fastened round*, but that it *does* mean *revolving round*, he has both the analogies of the word and the other

commentators against him. The main proof, if not the only proof, which he brings, is that Aristotle so construed it. Upon this point I join issue with him. I maintain that Aristotle does *not* understand εἰλομένην or ἰλλομένην περὶ as naturally meaning *revolving round*, and that he does understand the phrase as meaning *fastened round*. When we find him, in the second passage of the treatise De Cælo, not satisfied with the verb ἔλλεσθαι alone, but adding to it the second verb καὶ κινεῖσθαι, we may be sure that he did not consider ἔλλεσθαι as naturally and properly denoting *to revolve* or *move round*.

Agreeing as I do with Gruppe in his view, that the interpretation put by Aristotle is the best evidence which we can follow in determining the meaning of this passage in the Timæus, I contend that the authority of Aristotle contradicts instead of justifying the conclusion at which he arrives. Aristotle understands ἰλλομένην as meaning *packed or fastened round*; he does not understand it as meaning, when taken by itself, *revolving round*.

The two meanings here indicated are undoubtedly distinct and independent. But they are not for that reason contradictory and incompatible. It has been the mistake of critics to conceive them as thus incompatible; so that if one of the two were admitted, the other must be rejected. I have endeavoured to show that this is not universally true, and that there are certain circumstances in which the two meanings not only may come together, but must come together. Such is the case when we revert to Plato's conception of the cosmical axis as a solid revolving cylinder. That which is packed or fastened around the cylinder must revolve around it, and along with it.

Both M. Boeckh and Gruppe assume the incompatibility of the two meanings; and we find the same assumption in Plutarch's criticisms on the Timæus (Plutarch. Quæst. Platon. p. 1006 C), where he discusses what Plato means by ὄργανα χρόνου; and in what sense the earth as well as the moon can be reckoned as ὄργανον χρόνου (Timæus, p. 41 E, 42 D). Plutarch inquires how it is possible that the earth, if stationary and at rest, can be characterised as “among the instruments of time;” and he explains it by saying that this is true in the same sense as we call a gnomon or sun-dial an instrument of time, because, though itself never moves, it marks the successive movements of the shadow. This explanation might be admissible for the phrase ὄργανον χρόνου; but I cannot think that the immobility of the earth can be made compatible with the attribute which Plato bestows upon it of being φύλαξ καὶ δημιουργὸς νυκτὸς τε καὶ ἡμέρας.

The difficulty, however, vanishes when we understand the function ascribed by Plato to the earth as I have endeavoured to elucidate it. The earth not only is not at rest, but cannot be at rest, precisely because it is packed round the solid revolving cosmical axis, and must revolve along with it. The function of the earth, as the first and oldest of intra-kosmic deities, is to uphold and regulate the revolutions of this axis, upon which depend the revolutions of the sidereal sphere or outer shell of the kosmos. It is by virtue of this regulating function (and not by virtue of its rotation) that the earth is the guardian and artificer of night and day. It is not only “an instrument of time,” but the most potent and

commanding among all instruments of time.

What has just been stated is, in my belief, the theory of the Platonic Timæus, signified in the words of that dialogue, and embodied in the comment of Aristotle. The commentators, subsequent to Aristotle, so far as we know them, understood the theory in a sense different from what Plato intended. I think we may see how this misconception arose. It arose from the great development and elaboration of astronomical theory during the two or three generations immediately succeeding Plato. Much was added by Eudoxus and others, in their theory of concentric spheres: more still by others of whom we read in Cicero (Academ. II. 39.) “Hicetas Syracusius, ut ait Theophrastus, coelum, solem, lunam, stellas, supera denique omnia, stare censet, neque praeter terram rem ullam in mundo moveri: quae cum circum axem se summâ celeritate convertat et torqueat, eadem effici omnia, quae si stante terrâ coelum moveretur. Atque hoc etiam Platonem in Timaeo dicere quidam arbitrantur, sed paullo obscurius.” The same doctrine is said to have been held by Herakleides of Pontus, the contemporary of Aristotle, and by others along with him. (Simplikius ad Aristot. Physic. p. 64 — De Coelo, p. 132 — Plutarch. Plac. Phil. III. 13.) The doctrine of the rotation of the Earth here appears along with another doctrine — the immobility of the sidereal sphere and of the celestial bodies. The two are presented together, as correlative portions of one and the same astronomical theory. There are no celestial revolutions, and therefore there is no solid celestial axis. Moreover, even Aristarchus of Samos (who attained to a theory substantially the same as the Copernican, with the double movement of the Earth, rotation round its own axis, and translation round the sun as a centre) comes within less than a century after Plato’s death.

Though the *quidam* alluded to by Cicero looked upon the obscure sentence in Plato’s Timaeus as a dim indication of the theory of Hicetas, yet the two agree only in the supposition of a rotation of the earth, and differ essentially in the pervading cosmical conceptions. Hicetas states distinctly that which his theory denies, as well as that which it affirms. The negation of the celestial rotations, is in his theory a point of capital and coordinate importance, on which he contradicts both Plato and Aristotle as well as the apparent evidence of sense. I cannot suppose that this theory can have been proclaimed or known to Aristotle when his works were composed: for the celestial revolutions are the keystone of his system, and he could hardly have abstained from combating a doctrine which denied them altogether. In the hands of Hicetas (perhaps in those of Herakleides, if we may believe what is said about him) astronomy appears treated as a science by itself, with a view “to provide such hypotheses as may save the phenomena” (σώζειν τὰ φαινόμενα, Simpl. ad Aristot. De Coelo, p. 498, Schol. Brandis). It becomes detached from those religious, ethical, poetical, teleological, arithmetical decrees or fancies, in which we see it immersed in the Platonic Timaeus, and even (though somewhat less) in the Aristotelian Treatise De Coelo. Hence the meaning of Plato, obscurely announced from the beginning, ceased to be understood: the solid revolving axis of the Kosmos, assumed without being expressly affirmed in his Timaeus, dropped out of sight: the doctrine of the rotation of the earth was presented in a new point of view, as a substitute for the celestial revolutions. But no proper note

was taken of this transition. The doctrine of Plato was assumed to be the same as that of Hicetas.

When we read Plutarch's criticism (Quæst. Plat. p. 1006 C) upon the word ἰλλομένην, we see that he puts to himself the question thus — "Does Plato in the *Timæus* conceive the earth as kept together and stationary — or as turning round and revolving, agreeably to the subsequent theory of Aristarchus and Seleukus?" Here we find that Plutarch conceives the alternative thus — Either the earth does not revolve at all, or it revolves as Aristarchus understood it. One or other of these two positions must have been laid down by Plato in the *Timæus*. — So we read in Plutarch. But the fact is, that Plato meant neither the one nor the other. The rotation of the earth round the solid cosmical axis, which he affirms in the *Timæus* — is a phenomenon utterly different from the rotation of the earth as a free body round the imaginary line called its own axis, which was the doctrine of Aristarchus.

When expositors in Plutarch's day, and since his day, enquired whether or not the Platonic *Timæus* affirmed the rotation of the earth, they meant to designate the rotation of the earth in the sense of Aristarchus, and in the sense in which modern astronomy understands that capital fact. Now speaking the language of modern astronomy, I think it certain that the rotation of the earth is *not* to be found affirmed in the Platonic *Timæus*; and I agree with M. Boeckh when he says (Untersuch. p. 77), "Granting that Aristotle ascribed to Plato the doctrine of the rotation of the earth, he at least did not ascribe to him the doctrine as Gruppe assumes, and as now understood." As between Gruppe — who holds that the Platonic *Timæus* affirms the rotation of the earth, and that Aristotle ascribes it to him, in our sense of the words — and M. Boeckh, who denies this — I stand with the latter for the negative. But when M. Boeckh assumes that the only alternative doctrine is the immobility of the earth, and tries to show that this doctrine is proclaimed in the Platonic *Timæus* — nay, that no opposite doctrine *can* be proclaimed, because the discourse expressly announces the rotation of the sidereal heaven in twenty-four hours — I am compelled to dissent from him as to the conclusion, and to deny the cogency of his proof. M. Boeckh has hardly asked himself the question, whether there was not some other sense in which Plato might have affirmed it in the *Timæus*. I have endeavoured to show that there was another sense; that there are good analogies in Plato to justify the belief that he intended to affirm the doctrine in that other sense; and that the comments of Aristotle — while thoroughly pertinent, if we thus understand the passage in the *Timæus* — become either irrelevant, dishonest, or absurd, if we construe the passage as signifying either what is maintained by M. Boeckh or what is maintained by Gruppe.

The eminent critics, whose opinions I here controvert, have been apparently misled by the superior astronomical acquirements of the present age, and have too hastily made the intellectual exigencies of their own minds a standard for all other minds, in different ages as well as in different states of cultivation. The question before us is, not what doctrines are scientifically true or scientifically compatible with each other, but what doctrines were affirmed or implied by Plato. In interpreting him, we are required to keep our minds independent of subsequent astronomical theories. We must look, first and chiefly, to what is said by Plato himself; next, if that be obscure, to the construction and

comments of his contemporaries so far as they are before us. In no case is this more essential than in the doctrine of the rotation of the earth, which in the modern mind has risen to its proper rank in scientific importance, and has become connected with collateral consequences and associations foreign to the ideas of the ancient Pythagoreans, or Plato, or Aristotle. Unless we disengage ourselves from these more recent associations, we cannot properly understand the doctrine as it stands in the Platonic *Timæus*.

This doctrine, as I have endeavoured to explain it, leads to an instructive contrast between the cosmical theories of Plato (in the *Timæus*) and Aristotle.

Plato conceives the kosmos as one animated and intelligent being or god, composed of body and soul. Its body is moved and governed by its soul, which is fixed or rooted in the centre, but stretches to the circumference on all sides, as well as all round the exterior. It has a perpetual movement of circular rotation in the same unchanged place, which is the sort of movement most worthy of a rational and intelligent being. The revolutions of the exterior or sidereal sphere (Circle of the Same) depend on and are determined by the revolutions of the solid cylinder or axis, which traverses the kosmos in its whole diameter. Besides these, there are various interior spheres or circles (Circles of the Different), which rotate by distinct and variable impulses in a direction opposite to the sidereal sphere. This latter is so much more powerful than they, that it carries them all round with it; yet they make good, to a certain extent, their own special opposite movement, which causes their positions to be ever changing, and the whole system to be complicated. But the grand capital, uniform, overpowering, movement of the kosmos, consists in the revolution of the solid axis, which determines that of the exterior sidereal sphere. The impulse or stimulus to this movement comes from the cosmical soul, which has its root in the centre. Just at this point is situated the earth, “the oldest and most venerable of intra-kosmic deities,” packed round the centre of the axis, and having for its function to guard and regulate those revolutions of the axis, and through them those of the outer sphere, on which the succession of day and night depends — as well as to nurse mankind.

In all this we see that the ruling principle and force of the kosmos (τὸ ἡγεμονικὸν τοῦ κόσμου) is made to dwell in and emanate from *its centre*.

When we come to Aristotle, we find that the ruling principle or force of the kosmos is placed, not in its centre, but in its circumference. He recognises no solid revolving axis traversing the whole diameter of the kosmos. The interior of the kosmos is occupied by the four elements — earth, water, air, fire — neither of which can revolve except by violence or under the pressure of extraneous force. To each of them rectilinear motion is *natural*; earth moves naturally towards the centre — fire moves naturally towards the circumference, away from the centre. But the peripheral substance of the kosmos is radically distinct from the four elements: rotatory motion in a circle is *natural* to it, and is the only variety of motion natural to it. That it is moved at all, it owes to a *primum movens immobile* impelling it: but the two are coeternal, and the motion has neither beginning nor end. That when

moved, its motion is rotatory and not rectilinear, it owes to its own nature. It rotates perpetually, through its own nature and inherent virtue, not by constraining pressure communicated from a centre or from a soul. If constraint were required — if there were any contrary tendency to be overcome — the revolving periphery would become fatigued, and would require periods of repose; but, since in revolving it only obeys its own peculiar nature, it persists for ever without knowing fatigue. This peripheral or fifth essence, perpetually revolving, is the divine, venerable, and commanding portion of the kosmos, more grand and honourable than the interior parts or the centre. Aristotle lays this down (De Cœlo, ii. 13, p. 293, b. 10) in express antithesis to the Pythagoreans, who (like Plato) considered the centre as the point of grandeur and command, placing fire in the centre for that reason. The earth has no positive cosmical function in Aristotle; it occupies the centre because all its parts have a natural movement towards the centre: and it is unmoved because there *must be* something in the centre which is always stationary, as a contrary or antithesis to the fifth essence or peripheral substance of the kosmos, which is in perpetual rotation by its own immutable nature.

I do not here go farther into the exposition of these ancient cosmical theories. I have adverted to Aristotle's doctrine only so far as was necessary to elucidate, by contrast, that which I believe to be the meaning of the Platonic Timæus about the rotation of the earth.

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